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23rd Seminar on APEC Energy Supply and Demand Outlook Report

Venue: Iniu Building, Tokyo, Japan
Date: 1st to 5th August, 2016
Attendee: Jason Paniu, A/MRV Officer

Background

The Asia Pacific Energy Research Centre (APERC) was established in July 1996 in Tokyo, as an affiliate of the Institute of Energy Economics, Japan (IEEJ), pursuant to the Action Agenda[1] adopted by the Asia-Pacific Economic Cooperation (APEC) Economic Leaders at the Osaka Summit in November 1995. The Government of Japan generously agreed to host the Centre.

The primary objective of APERC is to foster understanding amongst APEC economies of global, regional and domestic energy demand and supply trends, energy infrastructure development, energy regulatory reform, and related policy issues in view of the regional prosperity. APERC advocates rational energy policy formulation and enhances capacity building in energy research in the region, following the APEC's Non-binding Energy Policy Principles for furthering energy security, economic growth, and environmental quality in an effort to implement our mission and vision.

APERC's activities for the current year onwards, including work on (1) Energy Demand and Supply Outlook, (2) Peer Review on Energy Efficiency, (3) Cooperative Energy Efficiency Design for Sustainability, (4) Peer Review on Low Carbon Energy Supply, and (5) Low Carbon Model Town Project, are directed at helping APEC members address these challenges.

Introduction

The APEC Energy Demand and Supply Outlook as mentioned earlier is one of the main activities undertaken by the APERC. The outlook is designed to provide a basic point of reference for anyone wishing to become more informed about the energy choices facing the APEC region. The business-as-usual projections illustrate the risks of the development path the APEC region is now on. Alternative scenarios examine options for improving sustainability. APERC normally prepares a new version of the Outlook every 2 or 3 years. Recent editions of the Outlook have been published in two volumes. Volume 1 discusses the outlook for the APEC region as a whole, and compares the outlook for the various APEC

[1] The Osaka Action Agenda provides a framework for meeting the Bogor Goals through trade and investment liberalization, business facilitation and sectoral activities, underpinned by policy dialogues and economic and technical cooperation. As part of this framework, General Principles have been defined for APEC member economies as they proceed through the APEC liberalization and facilitation process

economies. Volume 2 has provides an 'Economy Review' (chapter) discussing the outlook for each APEC economy. The current edition is the 6th Edition 2016.

The Seminar on Energy Supply and Demand Outlook is an annual event hosted by the APERC where participants from the APEC Economies are introduced to the type of methodology used in the Outlook as well as hands on experience using their own Economy data. Furthermore, each researcher presents his/her own section in the Outlook.

This was the 23rd Seminar which saw 10 participants from 8 APEC Economies namely Russia, Thailand, Mexico, Indonesia, Vietnam, Philippines, Malaysia and Papua New Guinea.

Purpose

The purpose of this report is to:

i. Briefly outline the details of the Seminar;
ii. The outcome of the Seminar; and
iii. The Gaps and Constrains Faced plus the way forward

Details of Seminar

As mentioned earlier the objectives of the Seminar was to firstly introduce to the APEC Economy participants the methodology used in the Energy Supply and Demand Outlook; Secondly, for the participants to have hands on experience on the Methodology; and thirdly for researchers to present on their sections in the Outlook as well as presentations on relevant researches. As such these three objectives were divided into the five days seminar which saw the first and half of the second day on the first objective, then half of the second day to half of the fourth day on the Second objective and finally the remaining was spent on the third objective. Below is a brief summary of how each objective was achieved during the five days seminar:

a. Methodology Used in the Energy Supply and Demand Outlook 6th Edition

i. Energy Balance table

The first step once all data have been collected is to enter them into an Energy Balance Table. An Energy Balance Table is an accounting table presenting a coherent picture of flows of all types of energy from their origin, through transformation processes to final use. It is a comprehensive model that represents information on physical flow of energy. The use of Energy Balance Table is that it:

- Provides a check on the completeness and accuracy of the data and a simple means of assembling the main statistics of each commodity so that key data are easily obtained.
- Serves as a natural starting point for the construction of various indicators of energy consumption
- Reveals the degree of dependency of the country to each kind of energy and the relative importance of different fuel supplies in their contribution to the economy
- Serves as basis for the analysis of environmental impact of the energy use
- Starting point for energy modelling

- Provides important information for energy policy formulation

ii. Energy Demand Modelling

Energy demand depends on human behavior or human activity. It is a relationship with determinants such as GDP and sectoral income, tariff, population based on econometric analysis. As such in Energy Demand Modelling, the econometric model is used. Econometric model is used to forecast future developments in the economy. It is a measure of past relationships among variables such as energy consumption in the Transport Sector, energy consumption in the industrial sector, consumer spending, household income, tax rates, GDP, population, fuel price and the like, and then forecast how changes in some variables will affect the future course of others.

In modelling it would be very helpful to use a tool. The difference between tools and models is that models are sets of conceptual or mathematical relationships while tools are computer software, which can numerically represent models. In practice, numeric model is dependent on tools as a model has to be numerically represented to be useful.

The tool used by the APERC researchers in the Energy Demand Outlook was the Simple Econometric Simulation System (SEE or Simple E). It is an Add-In application for Microsoft Excel and exploits all the advantages of the native spreadsheet functions as well as the open interfaces with other Windows applications. There are three processes involved in Simple-E, from data input (worksheet) to simulation (worksheet) namely; 1) Model Check; 2) Model Solve, and 3) Simulation.

Steps in an econometric model involves firstly coming up with an Economic Theory such as the demand for fuel in the transport sector depends of the population. The second step to formulate an Econometric Model by inserting economic data (independent variables) and energy demand data (dependent variables) into the tool, in this case Simple E tool. The third step is estimation, which is done automatically by the tool (Simple E). The fourth step is Specification testing and diagnostic checking. Now there are about 12 parameters for testing the fitness of the model. If the model is adequate then proceed to the next step which is the Hypothesis test, but if it is not adequate then you have to go back to the second step and insert a different economic data. The final step is Forecasting and simulation where you can actually see the past growth rate and the projected future growth rate.

iii. Energy (Power) Supply Modelling

The purpose for Power supply modelling is how to meet the power demand. Thus it is more to do with Physics and Engineering. It is about understanding the supply side of the economy and how to allocate resources. In a Power Development Plan the following factors have to be taken into consideration:

i. **Macro Economics & Demand** – Power Demand by Sector, Elasticities, Demand Side Energy Efficiency
ii. **Energy Policies** – Energy Mix, Domestic Supply, Import reduction, renewables, Energy Efficiency

iii. **Financing**- Costs, Cost of Finance, Tariff, Revenue
iv. **Technologies** – Supply side efficiency, Cost Reduction, Emissions of Pollutants, Grid integration
v. **Resource/Plant Constraints** – Resources of fossil fuels
vi. **Costs/Benefits: Government, Suppliers & Consumers** – Subsidies by Government, Revenue of Utilities
vii. **Environment Policies** – Air Pollution: CO_2, SO_x, NO_x, PM Emissions, Cost of Environment, Cost of mitigation, Land Use

b. Hands on experience on the Methodology

In the hands on experience we started with the energy demand modelling by using our own country data. The data we used were the amount of energy consumed by each of the subsectors as well as the source being consumed. Furthermore we also used the Socio Economic data which was to determine the driving factor of the energy consumption in each of these subsectors. The data was from 1990 to 2013 and we were to simulate to 2040 using the Simple E tool.

Since there we limited time to model all source such as fuel demand we only modeled the electricity demand in each of the subsectors. Thus obviously in PNG we do not have any electricity demand for the transport sector i.e. Trains which run on electricity, so unlike other APEC economies was left out. Furthermore, unlike other economies subsectors such as Residential, Commercial and Agriculture where combined as Other Sectors since there was no specific data on the amount of electricity consumed by each of these subsectors. Therefore the Sub Sectors that were modelled for the amount Electricity demand were Industrial Sector and Other Sectors and the results can be seen below:

Sub Sectors	**Driving Factors**	**Past Electricity Demand Growth rate in Subsector (1990 – 2013)**	**Future Electricity Demand Growth rate in Subsector (2014 – 2040)**
Industrial Sector	Real GDP	No demand growth rate	3.21%
Other Sectors	Real GDP	No demand growth rate	1.1%
	Population		

In the other hands on experience, participants were to determine the Power Supply by using the Power Plan Model. However, used pre-prepared data was used and not country specific data. In the exercise participants were asked to determine the amount of power that will be supplied by each power plant if the GHG emissions were to be reduced by 10% by 2040. Thus each participant came up with their own power plan model.

c. Presentation by Researchers

i. Business-as Usual case scenario

In the Business-as-Usual case, the presenter touched on the following key trends that highlight challenges:

- China and Southeast Asia drive APEC energy demand
- Renewables is the fastest-growing energy source
- Fossil Fuels remain dominant in the energy mix
- The APEC energy supply-demand gap widens
- CO_2 emissions continue rising as coal remains the largest power source.

i. Improved Efficiency Scenario

In the Improved Efficiency Scenario the presenter highlighted the following key messages:

- The Improved Efficiency Scenario shows 13% energy savings compared to BAU and demand peaks by 2029, saving 921 Mtoe.
- China provides the largest savings, accounting for 43% of the total.
- Industry provides the largest sector share-40% or 372Mtoe-of savings through promoting best available technologies (BAT)
- Fuel efficiency standards for vehicles are key to achieve the 15% reduction in demand in the transport sector.
- Buildings save 279 Mtoe (13%) from appliance and building envelope improvements. Heating and cooling are particularly important.
- APEC achieves its 45% energy intensity target by 2032 in this scenario, and is 49% lower than 2005 by 2035.

ii. Alternative Power Mix Scenario

In the Alternative power mix Scenario the presenter highlighted the following key messages:

- Prioritize the development of Clean Coal projects and strengthen their financing and economic viability
- Enhance gas and LNG trade and explore the development of domestic gas resources (conventional and unconventional)
- Increase safety standards of nuclear power plants and promote an informed public dialogue to change the social perception of these projects.

iii. Investment Outlook

In the Investment Outlook the presenter highlighted the following key trends and implications

- China and the United States drive the total investment requirement in the APEC region, with upstream and power sub-sectors capture more than half of the total.
- Although energy investment is just a small portion of GDP of individual economies, securing financing sources through long-term loans remains is a significant challenge
- Multilateral and development banks should play a crucial role in providing access to funds for energy investments.
- Government regulatory policies affecting energy markets should ensure a conducive business environment and lower investment risk.

iv. Energy Security and Climate Change

In Energy Security and Climate Change the presenter highlighted the following key messages:

- Regional cooperation may help to create a suitable business environment that attracts long-term financing
- Economies should carefully assess the investment implications of their policy agenda and initiatives.

- Diversity of primary energy supply in APEC is expected to improve as a result of higher share of renewables.
- Strengthening and expanding regional cooperation and trade within APEC can play important role in improving energy security.
- Acceleration technology development and deployment is central to establishing more secure and environmentally sustainable energy systems.
- APEC energy targets need to be enhanced to meet long term global climate objectives and economies should monitor and strengthen INDCs where possible.

Outcome

Having completed the one week seminar, I have gained enough knowledge and skills on how to do the Energy Demand modelling using the APERC model and tool used in the Energy Demand and Supply Outlook. I was able to model the electricity demand in the Industrial Sector and Other Sectors and thus was able to see the future demand growth from 2014 to 2040 and what are the main driving factors. Furthermore, I also have an idea on how to plan the power supply using the Power Plan Model.

Gaps and constraints

- About 50% of the Papua New Guinea data that was compiled by the APERC team and used during the hands on experience were based on estimation. Though they had a very low uncertainty, it would have still been great if actual data was used. Now the problem identified by the APERC team was that the lead agency in PNG which is the Department of Petroleum and Energy haven't been supplying data to them besides Petroleum data and JODI data which is being supplied on a regular basis. The reason being, DPE haven't been compiling Energy data over the years.

- There were missing data in the subsectors. While other economies were modelling the electricity demand for each subsector, PNG couldn't as there wasn't subsector specific data. And again this was due to the lack of coordination with the lead government agency.

Way Forward

The Simple E model and tool is very useful in coming with an Energy demand model from personal experience. Having seen from the hands on experience on energy demand modelling using country specific data, the projected rate of electricity demand in the Industrial Sector is higher than that of total of other sectors. This is due to the increase in the Oil and Gas extraction in PNG especially LNG as there will be an increase in its demand in the APEC region as outlined from the Outlook presentation. Though this may increase the country's GDP, we also have to consider our National Goal (Vision 2050) and International commitment (NDC) of being 100% renewable by 2050. This now lays in the hands of relevant government agencies on how we coordinate together to come with strategies and policies in maintaining the growth in the Industrial Sector as well as achieving our set goal and commitment.